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## ABSTRACT

This monograph presents a description, along with the purposes, of the Del Mod System. It is described as a system concerned with inducing changes in the existing systems in the area of science education. The investment of time and funds (a National Science Foundation-funded project) is devoted to an alteration of the behavior patterns of individuals. It is a cooperative working agreement with the University of Delaware, Delaware Technical and Community College, Department of Public Instruction, Delaware State College, the Delaware schools and industry. The origin, the specific objectives, and six major areas of concern are presented. The component institutions and their roles are described. The structure and funding as well as the first-year results of the program are included in the monograph. (EB)

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THE DELAWARE MODEL:  
A SYSTEMS APPROACH  
—DEL MOD SYSTEM—

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**THE DELAWARE MODEL:  
A Systems Approach  
(DEL MOD System)**

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During the past year the question has been asked many times in Delaware "What is the DEL MOD System and why is a systems approach to solving educational problems different from past approaches?" The systems strategy permits identification of needs for all of the participants—teachers, schools, state agencies, colleges and universities—and the development of appropriate actions. The immediate feedback can affect the revision of projects and acquisition of data about the educational process which can then be added to our existing reservoir of knowledge. The entire process involves continual formative evaluation and review of each project within the system as well as ongoing review and evaluation of the impact on the school.

Contemporary review of a systems-strategy reveals two kinds of systems. One is the temporary system which functions by bringing together participants for the purpose of their own education or reeducation in a situation removed from their normal working environment. Evaluation takes place in terms of the objectives for the system and not on changes which may occur when the participant returns to his normal environment. Conferences, institutes, summer school and workshops are examples of temporary systems.

The other kind of system is a permanent one. A permanent system may be thought of as the total school system, agency, or institution to which an individual devotes the major portion of his energy. To change a permanent system, time must be provided for individuals to identify the needs of their system and devote a portion of their energies to enacting a change. The individuals working to change their permanent system thus become changed themselves as they change their system. This interrelated change in individuals and in the system to which they belong is evaluated in terms of the demonstrable changes which occur and those changes which the individuals believe have occurred.

The DEL MOD System is concerned with inducing changes in the permanent systems in the area of science education. It may utilize temporary systems to bring about change, but the objectives of the temporary systems are in response to needs identified by individuals for a particular set of circumstances in their permanent systems. The investment of time and funds is devoted to an alteration of the behavior patterns of individuals. Del Mod is not engaged in the development or investment in science equipment, large scale production of materials, improvement of facilities, or isolated projects.

The DEL MOD System is a cooperative working agreement with the University of Delaware, Delaware Technical and Community College, Department of Public Instruction, Delaware State College, the Delaware schools and industry. It was formed to bring about changes in science education and to institutionalize the alterations. All of the science education resources of the state are woven together into a cohesive whole by individuals in the participating institutions performing specific tasks which are addressed to identified needs and objectives of science education. There is no attempt to impose a statewide curriculum or adoption of specific science programs. The DEL MOD System likewise does not impinge upon the right of local districts to select or develop their own programs but rather provide the expertise to bring about more effective utilization of existing resources, both human and material.

#### **ORIGINS OF DEL. MOD**

The systems approach to science education and the readiness to accept a cooperative working arrangement did not develop instantaneously as the result of one conference or meeting. A maturation period of about two years of trial and discussion between individuals was needed before any formal arrangement could take place. The seeds for evolution of the DEL MOD System appeared in 1968 in an unpublished paper by Uffelman and Purnell (1) citing cooperative projects between

the University of Delaware and the Department of Public Instruction. A subsequent study by Purnell in 1969 on *The Status of Science Teaching in Delaware* (2) provided the needs-assessment background for later development of objectives to meet the specific requirements of Delaware schools. Further discussion with institutional heads, National Science Foundation officials and Du Pont Company executives culminated in a meeting with Delaware's Governor Russell W. Peterson to explore the feasibility of pursuing the development of a cooperative plan. An ad hoc committee of institutional representatives was charged with the responsibility of developing the plan. Meetings, conferences and innumerable working sessions were held before the final document was ready for presentation in February, 1971.

## OBJECTIVES

The plan as developed embraces the following objectives:

1. Given the proper data, monitoring system, and feedback mechanism, changes in science education as reflected through changes in teacher attitudes, pre-service and inservice preparation programs, student attitudes and student achievement will be demonstrated over a five-year period as a result of research, cooperative planning, pilot projects, and preservice and inservice training.
2. Provided with a cadre of trained science leaders, individual schools, districts, or regions will improve teacher competence by emphasizing an interdisciplinary mix through continuing education programs. The nature and type of these programs will be determined by analysis of the present status of science education.
3. Given a group of science education leaders and sources of science education materials, individual schools will develop integrated science curricula with a built-in system for formative and summative evaluation.

4. Given the proper training, the schools will incorporate into their ongoing programs newly developed science curricula or modifications thereof—both preservice and inservice—and the sources from which to select materials.
5. Curriculum materials and instructional strategies will be developed, tested, and disseminated in the emergent areas of population-environment studies and marine-environment studies for classroom teachers K-12.
6. With the proper programs, leadership, and resources, teachers will develop, try out, evaluate, and modify programs, materials, and strategies for varying student-ability levels within their classrooms for an individualized approach to science education.
7. Given the leadership and dissemination techniques to encompass the language and methods common to science and mathematics, science teachers will demonstrate the relationship between mathematics and science in their classroom presentations by incorporating mathematical functions into daily classroom practices. Conversely, mathematics teachers will demonstrate the relationship of mathematics to science by using the process approach to mathematics in their classrooms.
8. Given the appropriate training, a group of educational technicians will demonstrate their contribution to an instructional team under the supervision of certified teachers.

## **CONCERNs**

DEL MOD System emphasizes six major areas of concern:

1. *Science Resource Centers*—strategically located to serve as:
  - a. repositories for teaching materials through which teachers may browse or from which they may borrow materials for a trial period.
  - b. centers for inservice education activities,
  - c. centers for district or group curricular development activities,

- d. focus for operations of science field agents, and
- e. centers for community use for interested science groups.

2. *Science Field Agents*—individuals operating from each center who are skilled in intrapersonal relationships and knowledgeable in modern practices in science education. The agents may be thought of as analogous to the agricultural extension agent and assist the teacher. They are the major disseminators of the materials found in the centers and the materials developed by curriculum projects. It is through its agents that the DEL MOD System hopes to reach every science teacher within a five-year period.
3. *Science Education Leadership Program*—designed to train promising teachers in the special skills needed to work with adults in inservice education programs.
4. *Inservice Education*—attention is given to statewide needs as well as local-district needs.
5. *Preservice Education*—training programs which give greater field experience at many levels before entering the active teaching profession.
6. *Baseline Data and Evaluation Studies*—the determination of teacher background and preparation, teacher understanding of science, student achievement, and student understanding of science as well as research into the causal relationships among the respective factors and constant ongoing evaluation of projects within the components.

When objectives and areas of concern were accepted by the institutions, each major institute developed its role in meeting the objectives and areas of concern which included the role of the Director.

#### **COMPONENT ROLES**

The component institutions and their roles are:

1. *University of Delaware*
  - a. Preparation of preservice secondary science teachers whose training includes competence in teaching modern science programs.

- b. Continuing education of science teachers—both secondary and elementary—beyond the baccalaureate level where greater depth of knowledge in both content and pedagogy is required which may or may not lead to an advanced degree. This may also indicate consultative assistance.
- c. Research, development and refinement of science teaching materials and methods to be used by others in preservice or inservice education.
- d. Creation and evaluation of new knowledge about educational theory and practice and basic scientific research.

*2. Delaware Technical and Community College*

- a. Provision of supportive services to the schools.
- b. Preparation of science education technicians who may be employed as paraprofessionals in the schools as a part of differentiated staffing patterns.

*3. Delaware State College*

- a. Preparation of preservice secondary science teachers and elementary teachers to whom training-competence in teaching modern science programs is a part.
- b. Continuing education of science teachers beyond the baccalaureate level—both elementary and secondary level—where broadening of the knowledge base is required. This may also imply consultative assistance.

*4. Department of Public Instruction*

- a. The assessment of needs of teachers, pupils, buildings, districts and the state as a whole.
- b. Coordination of DEL MOD activities with the federally-funded programs such as ESEA III, ESEA I, and other divisions of the Department of Public Instruction.
- c. Facilitation of programs of the field agents and DEL MOD Director into the schools.

- d. Dissemination of information about DEL MOD to teachers and schools.

**5. Director**

- a. Coordination of all activities into a cohesive framework.
- b. Administration of the project.
- c. Management of activities delegated as inherent to field agent operations with the creation of an interface between pedagogy and content.
- d. Execution of activities with the local districts which pertain to meeting a particular local need and are not a part of an ongoing program of one of the components.
- e. Management of research activities.

**STRUCTURE  
AND  
FUNDING**

The entire system is under the guidance of a group known as the Augmented Council of Presidents which at the time of the development of the plan was composed of the heads of each of the component institutions— Dr. Edward A. Trabant, President, University of Delaware; Dr. Luna I. Mishoe, President, Delaware State College; Mr. Paul K. Weatherly, President, Delaware Technical and Community College; Dr. Kenneth C. Madden, State Superintendent, Department of Public Instruction; and Dr. Robert Cairns, Governor's Science Advisor.

The Director of Del Mod holds adjunct appointment in all of the component institutions and is directly responsible to the Augmented Council of Presidents. Each institution also has its own coordinator.

The DEL MOD System is supported by the National Science Foundation and the Du Pont Company, the State of Delaware and private foundations. Funds from all sources except the state are held in trust by the University of Delaware as custodian and the University subvents the funds to the respective components.

## FIRST YEAR RESULTS

The DEL MOD System became an official entity on July 1, 1971. As a result of almost a year of cooperative operation, several developments have occurred which are noteworthy of mention. First, as a result of constant teacher feedback, the University of Delaware is moving from its traditional graduate school relationship with Delaware teachers toward a partnership arrangement with each learning from the other. In 1972-73 many University programs will involve small teams of teachers and college professors working in areas of mutual interest for the purpose of developing better methods and strategies for institutionalizing particular techniques. Second, the field agent program is based on a one-to-one relationship between the teacher and agent to improve the teacher's classroom efficiency. Extensive use is made of microteaching and videotaping as well as small group meetings and individual conferences. One factor of significance in the success of this program is thought to be the establishment of confidence and trust between the agent and the teacher. The manner in which the agents work with their people depends on the background level and preparation of the teacher. A Level I field agent program is designed for upper elementary teachers where it may be necessary to overcome the "fear of science" with an "instant success" syndrome. Level II delves into improved classroom practice while Level III is centered around leadership development. Feedback from the schools and the reception of the agents by the teachers is exceedingly good.

Delaware Technical and Community College has endeavored to make their Science Resource Center a community service facility by the involvement of numbers of lay people in the advisory process. Through this group it is intended to institute procedures to invoke a public awareness of science.

Delaware State College, a four-year baccalaureate institution in mid-Delaware whose major products are

teachers, has been experimenting with an outreaching program for preservice science teachers by building into their teacher training program clinical experience at an early level. This program is also attempting to train cooperating teachers in the content and strategies of modern science programs.

Equally commendable is the evolution of the role of the Department of Public Instruction into that of assumption of responsibility for needs assessment of teachers, pupils, buildings and districts and the continual dissemination of information to and from teachers, pupils, buildings and districts. The communication network, emergent as a function of a state education agency, promises to provide a model for other state education agencies.

Perhaps one of the most significant points about the first year of DEL MOD operation is the grassroots support at the local-school and local-district level. Each of Delaware's local districts is looking at its own needs in priority-order and transmitting these needs to the DEL MOD office. These needs are then presented to the institutional coordinators and field agents for their assistance in meeting these problems. This interinstitutional-interschool cooperation has been very successful and one result has been the reallocation of existing school resources to better use the expertise which can be provided through DEL MOD.

The DEL MOD System is no panacea for curing all the ills of the current educational system. Tremendous strides have been made in Delaware but the goal of demonstrated improvement of the extent and quality of science education is far from reached. A pattern is evolving and a system is developing which can be used with modifications by other disciplines, states and regions.

**REFERENCES**

1. Uffelman and Purnell, *Cooperative Projects in Science Education* unpublished, 1968.
2. Purnell C. H., *The Status of Science Teaching in Delaware*, Department of Public Instruction, Dover, Delaware, 1969.